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The construction conception of The Census Map drawing and managing system*

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1 The study status about Statistic GIS at home

Since P.R.China was founded, in order to investigate the situation of a country and national power completely, our country has carried through thirteen large-scale Census, also has been cognizant of the importance of application of GIS in Census. In 1996, the work book about the first National Census of Basic Units put forward that "We need to establish full normative directory systems of basic units that cover all departments in the country, which can .provide basis for all professional statistics which can establish scientific sample, and which can provide basic information for normalizing urban construction and establishing GIS". Also the measure and related detailed roles about the fifth National Census definitely ordained: "All the provinces and cities which can take the lead in establishing GIS if they can". In the direction of these policies, the academe and statistic departments do a mass of research about GIS. The research and application of GIS in Statistics mostly centralizes Census, and partially applies in Census of Basic Units, and emphasizes particularly on establishing GIS based on Census Data which has had.

In the direction of the General Survey Center of National Bureau of Statistics of China, Gansu Statistical Bureau cooperated with SuperMap GIS Technologies, Inc. and established "Gansu community economy GIS", which mainly faced professional applied needs inside Gansu Statistical Bureau, and realized conformity and integration of all kinds of professional statistic information. The system established Census Map Database from the least statistic district to village in Gansu Province., and realized the integration of Geographic Data, Human Population, Basic Unit, Macro Economy and Statistical Forms Data. This system established at the beginning of May 2002, and in December. 2002, it started to use in Gansu Statistical Bureau.

The General Survey Center of National Bureau of Statistics of China, SuperMap GIS Technologies, Inc. and National Geomatics Center of China (NGCC) cooperated and

took on National 863 Project Planning" The Foundation of the National Community Economy Statistics GIS", and established integration system assembling Macro Economy Data, Basic Unit Data, special data, and realized the macro scale integration of the geographic information and statistic information, and constructed three kinds of application system which faced different purpose: The Statistics Geographic Information Query Decomposition System which faced macro decision-making, the National Community Economy Statistics Geographic Information Publishing System which faced the share of statistics geographic information and the National Community Economy Statistics Electronic Map which faced the publishing of statistics geographic information.

The district of Qing Shan Baotou City Statistical Bureau and SuperMap GIS Technologies, Inc. cooperated and established "The district of Qing Shan Baotou City Economy and Society Statistics Geographic Information System", which realized the integration of statistics information and geographic information at the building level, and it mainly faces grass roots statistics departments which need to manage and analyze Microcosmic Statistics Data. This system established at the beginning of May 2004, and in November. 2004, it started to use in the district of Qing Shan Baotou City Statistical Bureau.

At the first National Census, Hangzhou Urban Statistical Bureau cooperated with Hangzhou Urban Planning Bureau, and made the general survey district sketch map electrification within the city, and formed the General Survey District Electronic Map, and then established Hangzhou Community Economy Statistics Geographic Information System, and realized exact orientation of Basic Units within Hangzhou City.

The project group of Shanghai Population Geographic Information System established Shanghai Population Geographic Information System using the fifth Census data and up-to-the-minute Remote Sensing Map, and technical problems such as how to establish geographic base map, how to realize the geographic location of Census Data, how to establish Geographic Statistics Basic Units of the population, and so on, and analyzed the function of the Population Geographic Information

System in town planning, decision-making managing of the government and the development of the enterprise, and researched mission, content and method of the data maintenance.

In the early 1990s, GIS was used to publishing Statistics Data at Hong Kong Statistical Bureau. They made CD product Supermap Hong Kong 1991 which included richness Census Data and could carry through the data' visual form and operation using Electronic Map. Then they made a series of products, such as Supermap Hong Kong 1996 and Supermap Hong Kong 2001, and so on. Hong Kong Statistical Bureau established Digital Mapping System, which entirely used GIS in Census firstly, at the result; the making of Census Map, the sending of census enumerators and the publishing of Census Data could be accomplished by GIS.

All levels of the administrative divisions which has founded Population Geographic Information System and been appraised by experts also include Hunan Province (Hunan Statistical Bureau, 2003), Shenyang Urban (Shenyang Urban Statistical Bureau, 2003), Mentougou Beijing (Mentougou District Statistical Bureau, 2002), Huangpu Shanghai (Huangpu District Population Committee, 2003), and so on.

2 The study background of general investigation drawing and managing system

The work to partition Census Region and Census District is important and basic work in Census, the rationality of the partition directly decides rate of progress of Survey and the quality of Survey Data. Although Economic Census, Census and Agriculture Census have their own partition methods, but the census maps of different census is either same or different. For example, the census region of different census is the same at the level of the village, but at the lower than village level, the partition of census district is different. The partition of district is based on the density of Basic Units in Economic Census; the partition of district is based on the density of population in Census, the partition of district is based on the density of ground in

Agriculture Census,. At present, these jobs mainly are done by handwork and paper maps. The managing of paper maps is discommodious, and is very difficult by recycled in all previous censuses. With the embedding of the application of GIS in statistics industry of China, before the beginning of a new round of census, it becomes the problem which we need to consider that whether to use GIS to establish Drawing and Managing GIS which faces all kinds of census regions and census districts at different census task.

This project which is brought forward is intimately related to the embedding of the application of GIS in statistics industry of China. Although it is relatively late that the application of GIS in statistics census of China, but through several years' practice, it has founded high-blooded foundation for large-scale application. Our country started to regard the foundation of Census GIS at the fifth Census in 2000, and Census GIS was founded firstly in Qingdao, Shanghai and Ningbo, etc; after the second Basic Units Census in 2002, the General Survey Center of National Bureau of Statistics of China established Community Economy Statistics Geographic Information System based on Basic Units Census in Gansu, whose minimal spatial cell achieved the level of villages and residents' committees; with the support of The National "863" Project Planning" The Foundation of the National Community Economy Statistics GIS" of The Ministry of Science and Technology in 2003, The General Survey Center of National Bureau of Statistics of China, SuperMap GIS Technologies, Inc. and National Geomatics Center of China (NGCC) cooperated and established the National Community Economy Statistics GIS at the level of nation, whose spatial cell was the level of county, and established Community Economy Statistics GIS at the level of county, whose spatial cell was building, and accumulated some foundation. At present, we urgently need to establish national level (including provinces, cities, counties, villages and towns and streets, villages and residents' committees, census districts, buildings, and so on) and multilevel census geographic database. In the course of census, a great deal of Acquisition census region or district maps was not digitized and summarized entirely, a great deal of Address Information can not corresponded to census region or district maps and can not founded digitized relation, so these

precious spatial information can not recycle at the census work at a later time, and can not take effect in the course of the developing and application of census data, and can difficultly realize comparative analysis based on spatial latitude of the data of the polygenic same and different sort censuses (such as Agriculture Census, Economic Census, Census, and so on) a the t microscopic level, so as to make prodigious squandering. So it becomes an important job to establish Drawing and Managing GIS of census regions and census districts at national level.

With the support of The National "863" Project, with the National Bureau of Statistics of China in the lead, with the help of National Geomatics Center of China (NGCC), Institute of Geography, Chinese Academy of Sciences, and SuperMap GIS Technologies, Inc., we starts to research drawing of the census map and the managing software. The purport to start this project is to enhance rationality of the partition of census regions and census districts, and to realize drawing and managing electronic census maps, and to provide a reference of spatial orientation for all kinds of statistics information.

The jobs which this project will achieve mainly including:

(1) The research of the drawing standard about the map of Economic Census: making the type, the element content, the sign schema, the standout mode, the specification, the quality and precise standard of all kinds of the map of Economic Census (such as census region maps, census district maps),and providing basis for the expression and issuance of production.

(2) The research of the census map database:researching data mode,structure and coding scheme of the censusmap database which consist of the remote sensing iamaging which has multisource and multiple solution, multiple stage administrative regionalization units (provinces, cities, counties, villages and towns and streets, and so on), microscopic statistics spatial units (census districts, buildings, railways and water bodies,and so on), geographical coding data, researching the census map database mode which is adjusted for China's specific conditions, and is nationwide, and is adjusted for multiple stage administrative regionalization units.

(3) Establishing the drawing software of census districts faced different levels' census

enumeraters, and the managing GIS software of census districts faced different levels' statistics department.

3 The overall mode of drawing and managing about district map

At present, our country mainly has four administrative levels' statistic agencies from national level to county level, which are National Bureau of Statistics, and Province (Municipality, municipality directly under the Central Government) Bureau of Statistics, and City (Region, autonomous prefecture, league) Bureau of Statistics, and County (municipal district, County-level city, banner) Bureau of Statistics. These statistic agencies are the principal part of the collection, codification and issuance of statistic information, they are the providers of statistic information, also are users of statistics geographic information integrated system.

In this system which is about to establish, National Bureau of Statistics will take charge of summarizing and managing "national statistics census map", provinces, cities and counties will take charge of summarizing and managing "statistics census map" beyond their own jurisdiction, each district, town and village will take charge of drawing and summarizing census district maps. "National statistics census map" mostly manage census maps from macroscopic level, each province and city partitions census regions by administration extension based on the data whose scale is 1:50000, each county draws and manages census dis tricts whose scale is 1:2000, 1:1000 or 1:500.

Because the map' range is different, to the city and developed areas, they commonly have the scales from 1:500 to 1:2000, which can be used to partition the town and village, but administrative border not always divide to streets and villages. To some undeveloped areas, they may not have big scale maps to partition. Under the circumstances, they can use other paper maps (such as tourist maps, administrative division maps) for background, then through scanning and matching to divide lower level' census region in partitioned system.

According to assignment' requests and practical characteristic, census map drawing system has two functions which are the district map' drawing and managing, county, city, province and

national levels mostly lay particular stress on the function of managing, and lower levels of county mostly lay particular stress on the function of drawing. Because our country has a vast territory, and each level of statistics departments have different needs to census map' management, so nation, province, city and county will take charge of managing and querying census maps, and lower levels of county will take charge of drawing census maps. Allow for the different scopes of system' managing, different levels will adopt different schemes. The background of nation, province and city will adopt spatial database managing, to satisfy the need of a large amount of data, the statistics chart of this level will adopt classification's indexes, to avoid the difficult problem of figural joining within large geographical region. Census maps of county level mostly adopt file mode to manage, to realize seamless joining within county level.

In order to ensure census map' joining at the national county level, we must adopt the mode of all levels to divide and summarize. That means dividing data region to county level in county, then distributes data to each county. Each county divides towns in the county map, and then distributes data to towns. By analogy, divide to census districts.

According to this scheme, census map database of national level can directly manage census district level; census map database of county level can directly manage building level. System partitioning adopting the data of 1:50000 will uniformly adopt WGS84 coordinated system, census map database of national level can realize seamless joining of national buildings.

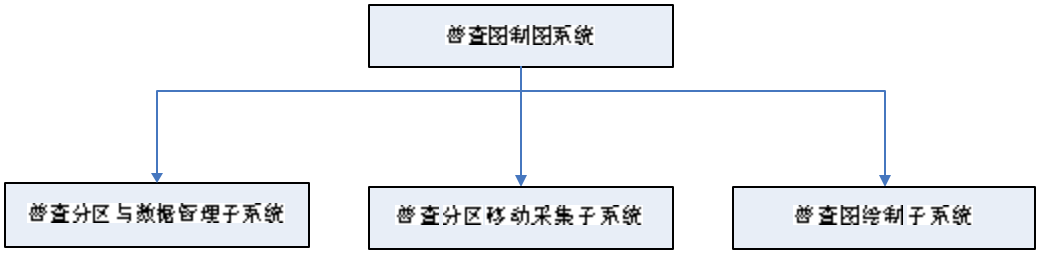
After census enumerators get census district' border which is uniformly divided, they can adopt many modes to draw census district map:

(1) Conditioned areas can adopt PDA+GPS, this mode can complete drawing all at once, indoor work does not need to draw map, but equipment' input-output is large, and the request to census enumerators relatively high.

(2) Also we can adopt traditional mode to draw census district map, print district to paper, and then draw based practical situation outside by census enumerators , then draw map inside. When draw outside, we must draw map within census district, forbid map exceeding.

4 The main function about the system

This system will be composed by three sub systems:



In these systems, census partitioning and data managing system mostly be used by statistics departments at the county and above county levels. Main functions include:

(1) Mostly deal with geographic information from various sources, include 1:50000 and other basic geographic information at middling and big scales, remote sensing data or navigate image data, converse data' format, converse coordinate, match data, and so on, at last, form geographic comparable data of census region or census district.

(2) Divide census region or census district, create data packet whose unit is census district or printing census district' original base map, for census data remotion collection system and census drawing software to use.

(3) Deal with directory systems of basic units, placename and address information.

(4) Summarize census maps, placename and address,basic unit data which is collected by census map software, and then join, summarize and verify data, at last, form three libraries' data which includes county census maps, placename and address, directory systems of basic units, use to found "Three Libraries".

Census partitioning motion system is based on census data motion collection terminal of PDA (or UMPC) and GPS, mostly be used by census enumerators. Main functions include:

(1) Receive census district data packet which be privoded by census partitioning and data managing system.

(2) Collect scene data, include buildings, streets, refenrece point and placename and address, and so on.

(3) Check basic units, input basic units and census tables.

(4) Data'mutual:collcetion information can be summonsed to census map drawing software to deal inside, and be summarized and joined by census partitioning and data managing system.

This system is a choice system, we can select according to different economic development.

Census map drawing software mostly be used by census enumerators: mostly deal with inside data at census district level, main functions include:

(1) Modify and edit census district map

(2) Digitallize the elements of census map

(3) Conformity three libraries data

(4) Checkout data and examine quality, and so on

(5) Create statistics district atlas

(6) Commute data with remotion collection system